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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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GENERAL ELECTRIC COMPANY
GLOBAL RESEARCH
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EXAMINER	
FETZNER, TIFFANY A	
ART UNIT	**PAPER NUMBER**
2859	

DATE MAILED: 09/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/065,036	ZHU ET AL.	
	Examiner	Art Unit	
	Tiffany A Fetzner	2859	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 July 2004*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8-15 and 17-39* is/are pending in the application.

4a) Of the above claim(s) *1-6,8 and 27-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *9-15,17-26 and 32-39* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) *1-6,8-15 and 17-39* are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *09/12/2002* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *07/09/2004*.
4) ☒ Interview Summary (PTO-413) Paper No(s)/Mail Date. *09/15/2004* .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

First DETAILED ACTION after RCE

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on July 1st 204 has been entered.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Drawings

3. The drawings are objected to by the examiner, because they fail to meet the requirements of the official draftsperson. [See the PTO 948 Official draftsperson review form attached to this office action.]

INFORMATION ON HOW TO EFFECT DRAWING CHANGES

Replacement Drawing Sheets

Drawing changes must be made by presenting replacement figures which incorporate the desired changes and which comply with 37 CFR 1.84. An explanation of the changes made must be presented either in the drawing amendments, or remarks, section of the amendment. Any replacement drawing sheet must be identified in the top margin as "Replacement Sheet" (37 CFR 1.121(d)) and include all of the figures appearing on the immediate prior version of the sheet, even though only one figure may be amended. The figure or figure number of the amended drawing(s) must not be

labeled as "amended." If the changes to the drawing figure(s) are not accepted by the examiner, applicant will be notified of any required corrective action in the next Office action. No further drawing submission will be required, unless applicant is notified.

Identifying indicia, if provided, should include the title of the invention, inventor's name, and application number, or docket number (if any) if an application number has not been assigned to the application. If this information is provided, it must be placed on the front of each sheet and centered within the top margin.

Annotated Drawing Sheets

A marked-up copy of any amended drawing figure, including annotations indicating the changes made, may be submitted or required by the examiner. The annotated drawing sheets must be clearly labeled as "Annotated Marked-up Drawings" and accompany the replacement sheets.

Timing of Corrections

Applicant is required to submit acceptable corrected drawings within the time period set in the Office action. See 37 CFR 1.85(a). Failure to take corrective action within the set period will result in ABANDONMENT of the application.

If corrected drawings are required in a Notice of Allowability (PTOL-37), the new drawings MUST be filed within the THREE MONTH shortened statutory period set for reply in the "Notice of Allowability." Extensions of time may NOT be obtained under the provisions of 37 CFR 1.136 for filing the corrected drawings after the mailing of a Notice of Allowability.

Election/Restriction

Group 1. **Claims 1-6, 8** and **27-31**, drawn to an imaging apparatus for producing a magnetic resonance image of a subject, classified in class 324 subclass 318.

Group 2. **Claims 9-15, 17-26** and **32-39**, drawn to a method for producing an image from an extended volume of interest within a subject using a magnetic resonance imaging (MRI) system where the extended volume of interest is larger than an imaging portion of a magnet within the MRI system, classified in class 324, subclass 309.

The inventions are distinct, each from the other because of the following reasons:

4. Inventions of Group 1 and Group 2 are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because Group 1 is drawn to any magnetic resonance apparatus that is capable of producing an image, and does not require the main feature of Group 2, that the image produced is of an extended field of view. Group 1 encompasses every MRI apparatus which is functional to produce an image, and is not restricted to an extended field of view therefore criteria (1) is satisfied. The subcombination has separate utility such as the ability to image a volume of interest that is larger than a portion of the conventional MR magnet, which distinguishes the method of Group 2 from the generic apparatus of Group 1, therefore criteria (2) is satisfied.

5. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

6. Because these inventions are distinct for the reasons given above and the search required for Group 1 is not required for Group 2, restriction for examination purposes as indicated is proper.

7. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art because of their recognized divergent subject matter, restriction for examination purposes as indicated is proper.

8. During a telephone conversation with Attorney **Jean K. Testa Reg. No. 39,396** on September 14th 2004 a provisional election was made **without traverse** to prosecute the invention of **Group 2, claims 9-15, 17-26** and **32-39** Affirmation of this election must be made by applicant in replying to this Office action. **Claims 1-6, 8,** and **27-31 are withdrawn from further consideration by the examiner**, 37 CFR 1.142(b), as being drawn to a non-elected invention.

9. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Canceled claims

10. The examiner notes that originally dependent **claims 7,** and **16,** were added into the independent claims by the December 10th 2003 amendment, and that **original dependent claims of 7 and 16 have been cancelled**, as per applicant's December 10th 2003 amendment and response.

Response to Arguments

11. Applicant's arguments filed **July 1st 2004** have been fully considered but they are not persuasive. Applicant's arguments, see remarks pages 7-9 of the amendment and response, filed **July 1st 2004**, with respect to the rejection(s)of **claim(s) 9-15** and **16-26** under 35 U.S.C. 103(a) have been fully considered and are persuasive, in view of applicant's RCE amended limitations to the claims, because the examiner agrees that the features added by amendment are not present in the applied **Machida** US patent application publication 2002/0115929 A1 published August 22nd 2002; with an effective filing date of September 21st 2001; and **Wang et al.**, US patent 5,928, 148 issued July 27th 1999 references. Therefore, the rejections have been withdrawn.

12. However, upon further consideration, a new ground(s) of rejection is made in view of the prior arts applied below. The new grounds of rejection has been necessitated by applicant's amendments to the claims, and the additional new claims presented with the RCE amendment.

13. Applicant's amendments to **independent claims 1, 9,** and **18** necessitated a new / updated search, for additional pertinent prior art, specifically concerning the amended limitations. The RCE amendments also necessitated the restriction requirement above since amended independent claim 1, and its respective dependent claims no longer concern the same inventive scope as claimed in amended dependent claims 9, 18 and the respective dependent claims which extend from RCE amended claims 9 and 18.

Claim Rejections - 35 USC § 103

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

15. The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

16. **Claims 9-15, 17-26** and **32-39** are rejected under **35 U.S.C. 103(a)** as being unpatentable over **Brittain** US patent application publication 2002/0140423 A1 published October 3rd 2002; with an effective filing date of October 5th 2001; in view of **Pelc et al.,** US patent 6,445,181 B1 issued September 3rd 2002, filed November 9th 2000.

17. With respect to **Amended Method claim 9, Brittain** teaches and / or shows "A method for producing an image from an extended volume of interest within a subject using a Magnetic Resonance Imaging (MRI) system where the extended volume of interest is larger than an imaging portion of a magnet within the MRI system", {See page 1 paragraphs [0009], and pages 1-2 paragraph [0011]} "the method comprising: translating the volume using a positioning device" [See figure 1 the patient positioning device 48 which controls and moves the patient table / couch / bed / platform / support] "along an axis of the MRI system and imaging portions of the volume when they are within the imaging portion of the magnet;" {See Figures 1 through 5 and figure 8 through 11; abstract; page 1 paragraph [0005]; page 1 paragraph page 5 paragraph [0049] through page 10 paragraph [0079]; figures 8 through 11}

18. **Brittain** also teaches and suggests the step of "detecting a plurality of MR signals from at least one radio frequency (RF) coil array for a given field-of-view within the MRI system as the positioning device is translating the volume;" {See Figures 8-11 page 5 paragraph [0049]through page 6 paragraph [0054]; 9 paragraph [0077] through page 10.}. "sending the plurality of MR signals to" an RF receiver coil assembly {See page 9 paragraph [0077] and page 1 paragraph [0007].}

19. Additionally, the examiner notes that the RF coil assembly of **Brittain** is an RF transceiver coil assembly which comprises at least one RF coil assembly (i.e. a plurality of RF coils is part of the scope of the **Brittain** reference page 9 paragraph [0077], (i.e. this limitation is also taught by **Brittain** to be known from the prior art on page 1 paragraph [0007]), and therefore directly suggests applicant's "plurality of reception coils" that is capable of excitation / transmission as well as detection / reception of the acquired MR signals.} The receivers (i.e. the RF coil assembly of **Britain**) "being adapted to adjust a receiver parameter; wherein the receiver parameter is adjusted based on direction of the image parallel to a motion of the subject" (i.e. the received acquired k-space signals are adjusted to account for motion along (i.e. "parallel to") the z imaging axis which is the axis of continuous patient motion, with the data then being sorted and aligned to match anatomic z locations, (i.e. directions of the image which are

parallel to a motion of the subject.)) {See page 6 paragraph [0054] through page 10 paragraph [0080]}.

20. **Brittain** also teaches and / or shows "computing a plurality of respective sub-images" (i.e. a series of acquisition positions) {See page 7 paragraph [0058] through page 8 paragraph [0068]}, "corresponding to the plurality MR signals for the" receiver(s) of the RF coil assembly "and for the given field-of-view (FOV) at a plurality of incremented locations of the subject; and, combining the plurality of respective sub-images to form a composite image of the volume of interest" {See Figures 8 through 11; page 7 paragraph [0058] through page 10 paragraph [0080]}.

21. The limitation of "wherein the combining comprises combining a central portion of each sub-image to form the composite image" is taught and suggested by **Brittain** because the data is constantly restricted to the selected slab within the optimal imaging volume, and because **Brittain** teaches that data at the slab edges can be dropped to improve data alignment or combining data from the center of k-space for each imaged location to be acquired at the point of optimal contrast. {See page 7 paragraph [0059] through page 8 paragraph [0067].

22. **Brittain** lacks directly teaching that there are explicitly "a plurality of receivers" configured in adjust the receiver parameter with the exact terminology of "based on a direction of the image parallel to a motion of the subject". However **Brittain** teaches a multi-slice imaging technique, which may use at least one RF coil assembly, or the array of receiver coils from the known prior arts, {See page 1 paragraph [0007], page 9 paragraph [0077]} for imaging a plurality of regions while the object is continuously moved, with the acquired data being aligned and matched to anatomical location in a direction parallel to the z-axis direction of table motion. {See page 7 paragraph [0061] through page 9 paragraph [0075]}.which does suggest applicant's terminology of "based on a direction of the image parallel to a motion of the subject".

23. Additionally, it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify and / or combine the RF coil assembly teaching of **Brittain** to include a "a plurality of receivers" in a configuration as shown by **Pelc et al.,** Figure 1 because the **Brittain** reference specifically teaches that the use of

a plurality or array of receivers is known from the prior art. {See page 1 paragraph [0007] and **Brittain** also teaches that the system of coils is capable of moving relative to the subject, {See page 6 paragraph [0054], which directly suggests that the coil configuration of **Pelc et al.,** is also usable to carry out the method of the **Brittain** reference}. The examiner also notes that simply increasing the number of reception coils is **not** a novel, non-obvious modification, because substituting an array of coils for a single coil; or a single coil for a plurality of coils, is a readily obvious modification to an individual of ordinary skill in the art.

24. With respect to **Amended Method claim 18**, **Brittain** teaches and / or shows "A method for imaging an extended volume of interest within a subject using a Magnetic Resonance Imaging (MRI) system {See page 1 paragraphs [0009], and pages 1-2 paragraph [0011]} "comprising: translating the subject into an imaging portion of a magnet assembly of the MRI system; [See figure 1 the patient positioning device 48 which controls and moves the patient table / couch / bed / platform / support] "along an axis of the MRI system and into the imaging portion of the magnet;" {See Figures 1 through 5 and figure 8 through 11; abstract; page 1 paragraph [0005]; page 1 paragraph page 5 paragraph [0049] through page 10 paragraph [0079]; figures 8 through 11} "detecting a plurality of MR signals from a radio frequency (RF) coil array;" {See Figures 8-11 page 5 paragraph [0049]through page 6 paragraph [0054]; 9 paragraph [0077] through page 10.}, "and, sending the plurality of MR signals" {see figure 1} "to a" receiver assembly, (i.e. receiver 56 of Figure 1, which may be one RF receiver or an array of RF reception coils as is known from page 1 paragraph [007]) "the receiver being adapted to adjust a receiver parameter; wherein the receiver parameter is adjusted based on direction of the image parallel to a motion of the subject" (i.e. the received acquired k-space signals are adjusted to account for motion along (i.e. "parallel to") the z imaging axis which is the axis of continuous patient motion, with the data then being sorted and aligned to match anatomic z locations, (i.e. directions of the image which are parallel to a motion of the subject.)) {See page 6 paragraph [0054] through page 10 paragraph [0080]}.

25. **Brittain** teaches and / or shows the step of "reconstructing at least one image of the volume of interest by computing a plurality of respective sub-images corresponding to the plurality MR signals" from the receiver "and for the given field-of-view (FOV) at a plurality of incremented locations of the subject as the subject is translated and combining the plurality of respective sub-images to form a composite image of the volume of interest" (i.e. a image of a patients abdomen). {See Figures 8-11; page 5 paragraph [0049] through page 10 paragraph [0080]}

26. The limitation of "wherein the combining comprises combining a central portion of each sub-image to form the composite image" is taught and suggested by **Brittain** because the data is constantly restricted to the selected slab within the optimal imaging volume, and because **Brittain** teaches that data at the slab edges can be dropped to improve data alignment or combining data from the center of k-space for each imaged location to be acquired at the point of optimal contrast. {See page 7 paragraph [0059] through page 8 paragraph [0067].

27. **Brittain** lacks directly teaching that there are explicitly "a plurality of receivers" configured in adjust the receiver parameter with the exact terminology of "based on a direction of the image parallel to a motion of the subject". However **Brittain** teaches a multi-slice imaging technique, which may use at least one RF coil assembly, or the array of receiver coils from the known prior arts, {See page 1 paragraph [0007], page 9 paragraph [0077]} for imaging a plurality of regions while the object is continuously moved, with the acquired data being aligned and matched to anatomical location in a direction parallel to the z-axis direction of table motion. {See page 7 paragraph [0061] through page 9 paragraph [0075]}.which does suggest applicant's terminology of "based on a direction of the image parallel to a motion of the subject".

28. Additionally, it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify and / or combine the RF coil assembly teaching of **Brittain** to include a "a plurality of receivers" in a configuration as shown by **Pelc et al.,** Figure 1 because the **Brittain** reference specifically teaches that the use of a plurality or array of receivers is known from the prior art. {See page 1 paragraph [0007] and **Brittain** also teaches that the system of coils is capable of moving relative to

the subject, {See page 6 paragraph [0054], which directly suggests that the coil configuration of **Pelc et al.,** is also usable to carry out the method of the **Brittain** reference}. The examiner also notes that simply increasing the number of reception coils is **not** a novel, non-obvious modification, because substituting an array of coils for a single coil; or a single coil for a plurality of coils, is a readily obvious modification to an individual of ordinary skill in the art. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claim 9** also apply to **claim 18**.

29. With respect to method **claim 10**, and **corresponding method claim 21**, which depend respectively from amended **independent method claims 9**, and **18; Brittain** teaches and shows that "the at least one rf coil array is mounted on a fixture that is disposed about the subject. {See RF coil reception assembly 56, Figure 1 and page 1 paragraph [0007]}. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 10,** and **21**.

30. With respect to method **claim 11**, and **corresponding method claim 22**, which depend respectively from amended **independent method claims 9**, and **18; Brittain** teaches and shows that "the fixture and rf coil array mounted thereon are stationary relative to the static magnetic field." {See Figure 1} The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9, 10, 18,** and **21** also apply to **claims 11** and **22**.

31. With respect to method **claim 12**, and **corresponding method claim 23**, which depend respectively from amended **independent method claims 9**, and **18; Brittain** lacks directly teaching that "the fixture and rf coil array mounted thereon are moveable relative to the static magnetic field." However, **Pelc et al.,** teaches that this limitation is an alternative configuration with a plurality of reception coils. {See abstract, figure 1; col. 2 line 4 through col. 4 line 65} Therefore, because the substitution of a plurality of receiver coils for a single receiver coil is well known, {See the rejection of claims 9, 18} the modification taught by **Pelc et al.,** when using a plurality of reception coils would also have been obvious to one of ordinary skill in the art at the time that the invention was made. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims, 9, 10, 18,** and **21** also apply to **claims 12** and **23**.

32. With respect to method **claim 13**, and **corresponding method claim 20**, which depend respectively from amended **independent method claims 9**, and **18; Brittain and Pelc et al.,** show "the at least one rf coil array comprises a plurality of coil elements arranged in a orthogonal distribution relative to a frequency encoding direction" {See Figure 1 or **Brittain** and figure 3 of **Pelc et al.,**}. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 13** and **20**.

33. With respect to method **claim 14**, and **corresponding method claim 24**, which depend respectively from amended **independent method claims 9**, and **18; Brittain** teaches and shows that "at least one rf coil array detects the MR signals concurrently with the translation of the positioning device". {See page 5 through page 6 of paragraph [0049]}.The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 14** and **24**.

34. With respect to **method claim 15**, and **corresponding method claims 25**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Brittain** teaches and shows that "the translating step is repeated until a selected length of the subject has been imaged inside the imaging portion of the magnet." {See Figures 8-11, abstract,; page 1 paragraph [0009] through page 2 paragraph [0013]; page 5 paragraph [0049] through page 10 paragraph [0080]}. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 15** and **25**.

35. With respect to **method claim 17**, and **corresponding method claims 19**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Brittain** teaches and shows that "the extended volume of interest" (i.e. of a patients abdomen which extends beyond the fixed range of the single multislice RF coil array), acquires slices as the patient is translated into the MR device in a "head-to-toe" direction, {See Figures 1, 8 and page 2 paragraph [0012] where the patient table is movable fore and aft directly suggesting either a head-to-toe or a "toe-to-head" image.}. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 17** and **19**.

36. With respect to **method claim 26**, **Brittain** teaches and shows that "the translating step is substantially continuous". {See abstract, page 5 paragraph [0049], page 10 paragraph [0080] and the entire reference in general as substantially continuous translation of the patient is a main goal of the **Brittain** reference. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claim 26**.

37. With respect to **method claim 32**, and **corresponding method claims 36**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Brittain** teaches and shows that "the receiver parameter comprises a receiver frequency, (i.e. the Larmour resonance frequency {See page 1 paragraph [0003]) "and wherein the receiver frequency is adjusted in response to a translation of the positioning device;" {See page 7 paragraph [0064]} "wherein the receiver frequency is adjusted when a frequency encoding direction of the image is parallel to an axis of a motion of the subject". {See page 7 paragraphs [0059] through [0064] where the data is aligned and frequency adjusted to match anatomic z locations in the same direction (i.e. parallel to the axis of patient table motion.)} The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 32** and **36**.

38. With respect to **method claim 33**, and **corresponding method claims 37**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Brittain** teaches and shows that "the receiver parameter comprises a receiver phase, and wherein the receiver phase is adjusted in response to a translation of the positioning device; wherein the receiver phase is adjusted when a phase encoding direction of the image is parallel to an axis of a motion of the subject". {See page 9 paragraph [0075] where the receiver phase encodes different locations with different orderings when motion in the table direction is continuous.} The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 33** and **37**.

39. With respect to **method claim 34**, and **corresponding method claims 38**, which depend respectively from **independent method claim 9**, and **independent**

method claim 18; Brittain teaches and shows that "the rf coil array is configured to adjust a transmit frequency in response to a translation of the positioning device; {See page 7 paragraph [0064] where the frequency is adjustable as needed to encode locations in the direction of patient motion.} "and wherein the transmit frequency is adjusted when a slice selection direction (i.e. the z-direction) "of the image is parallel to an axis of a motion of the subject". The examiner notes that in the **Brittain** reference the z-direction is taught to be parallel to the direction of table motion throughout the reference. Additionally, {See page 7 paragraphs [0059] through [0064] where the data is frequency adjusted and aligned to match anatomic z slice-selection locations in the same direction (i.e. parallel to the axis of patient table motion.)} The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 34** and **38**.

40. With respect to **method claim 35**, and **corresponding method claims 39**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Brittain** lacks directly teaching that "the computing of the sub-images acquired from each receiver is offset by a fraction of the field of view, wherein the fraction of the field of view equals the field of view divided by a number of receivers." However, **Pelc et al.,** teaches this limitation. [See **Pelc et al.,** col. 2 lines 59-67 ; col. 3 lines 13-29 ; col. 3 lines 37-45; col. 3 line 54 through col. 4 line 3; and especially col. 4 lines 18-33 where in a four coil receiver system the offset for $\Delta Z/Z$ is ~0.25 with a 75% efficiency for a given FOV; and se also col. 4 lines 50-65].

41. The examiner notes that it also would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the teaching of **Brittain** with the teaching of **Pelc et al.,** because the **Brittain** reference specifically teaches that the scope of the reference includes the ability to have the coil system move relative to the subject, or to move the patient on the patient table relative to the system. {See **Brittain** paragraph [0054]}. Additionally, **Brittain** teaches in paragraph [0007] on page 1 that "other known systems (i.e. such as the system of **Pelc et al.,**) employ stepped table and/or moving table approach with an array of receiver coils that move with the imaged object. Therefore, the ability to combine/modify the apparatus of **Brittain** with the multi-

moveable coil array receivers of **Pelc et al.,**) where the "computing of the sub-images acquired from each receiver is offset by a fraction of the field of view" (i.e. to account for when each sub-image is within the homogeneous region, or as in the case of **Brittain** "restricted to the specific slab thickness within the optimal imaging volume") and , "wherein the fraction of the field of view" (i.e. the restricted slab thickness) "equals the field of view divided by a number of receivers." {See the entire **Brittain** reference, page 9 paragraph [0077] through page 10 paragraph [0080] and page 1 paragraph [0007] where the RF assembly may be an array of RF coils.} The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 35** and **39**.

42. **Claims 9-15, 17-26** and **32-39** are also rejected under **35 U.S.C. 103(a)** as being unpatentable over **Hajnal** US patent 6,385,478 issued May 7th 2002, filed December 21st 1999;in view of **Pelc et al.,** US patent 6,445,181 B1 issued September 3rd 2002, filed November 9th 2000,

43. With respect to **Amended Method claim 9**, **Hajnal** teaches and / or shows "A method for producing an image from an extended volume of interest within a subject using a Magnetic Resonance Imaging (MRI) system where the extended volume of interest is larger than an imaging portion of a magnet within the MRI system", {See abstract, col. 2 lines 29-32} "the method comprising: translating the volume using a positioning device" [See figures 1-3, 9 where the motor component 6 controls and moves the patient table / couch / bed / platform / support] "along an axis of the MRI system for imaging portions of the volume when they are within the imaging portion of the magnet;" {See Figures 1-3 and figure 9; abstract; col. 3 lines 38-55}

44. **Hajnal** also teaches and suggests the step of "detecting a plurality of MR signals from at least one radio frequency (RF) coil array (i.e. component 10)for a given field-of-view within the MRI system as the positioning device is translating the volume;" {See Figures 1-3, 9, 7c col. 5 line 28 through col. 6 line 19}

45. Additionally, the examiner notes that the RF coil assembly of **Hajnal** is an RF coil assembly which comprises at least two RF coils coil 9 for RF transmission and coil 10 for reception. [See col. 3 line 62 through col. 4 line 3] **Hajnal** also teaches that the

receive coil 10 is adapted to adjust a receiver parameter;" (i.e. control the velocity of the patient table in the direction of table motion) [See col. 5 line 30 through col. 6 line 65] "wherein the receiver parameter" (i.e. the velocity of the patient table) "is adjusted based on direction of the image parallel to a motion of the subject" (i.e. the received acquired k-space signals are adjusted to account for motion along (i.e. "parallel to") the z imaging axis which is the axis of continuous patient motion, with the data then being sorted and re-aligned to match z locations, (i.e. directions of the image which are parallel to a motion of the subject along the z-axis.)) [See page 5 line 28 through col. 7 line 25].

46. **Hajnal** also teaches and / or shows "computing a plurality of respective sub-images" (i.e. a series of acquisition positions) {See col. 5 line 30 through col. 7 line 26, especially col. 6 lines 6-18, where multiple sub-images comprise a continuous seamless length of time 3D image data, "corresponding to the plurality MR signals for the" receiver(s) of the RF coil assembly, "and for the given field-of-view (FOV) at a plurality of incremented locations of the subject; [See col. 5 line 30 through col. 7 line 26,].

47. Additionally, **Hajnal** also teaches "combining the plurality of respective sub-images to form a composite image of the volume of interest" [See col. 6 line 6 through col. 7 line 25]. The limitation of "wherein the combining comprises combining a central portion of each sub-image to form the composite image" is taught and suggested by **Hajnal** [See col. 6 lines 19-43].

48. **Hajnal** lacks directly teaching that there are explicitly "a plurality of receivers" configured in adjust the receiver parameter with the exact terminology of "based on a direction of the image parallel to a motion of the subject". However **Hajnal** teaches a multi-slice imaging technique, [See col. 6 line 66 through col. 7 line 25] "which may use at least one RF coil assembly, (i.e. RF coils 9 and 10 comprise the coil assembly and do constitute an at least two RF coil plurality) for imaging a plurality of regions while the object is continuously moved, with the acquired data being aligned and matched to locations in a direction parallel to the z-axis direction of table motion. [See col. 3 line 38 through col. 7line 25; especially col. 5 lines 1-5; and col. 5 line 30 through col. 6 line 65, which does suggest applicant's terminology of "based on a direction of the image parallel to a motion of the subject.

49. Additionally, it would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify and / or combine the RF coil assembly teaching of **Hajnal** to include a "a plurality of receivers" in a configuration as shown by **Pelc et al.,** Figure 1 because the **Hajnal** reference specifically teaches using a series of frequency offsets for the different data volumes A, B, C, D with multi-sequence echo imaging, and is well known that an array of four reception coils, which has each coil tuned to a separate frequency, (i.e. the configuration of **Pelc et al.**,) permits four times more signal data to be acquired in a single scan, as opposed to having to re-adjust the frequency of a single coil, for each new A, B,C, D, volume. The examiner also notes that simply increasing the number of reception coils is **not** a novel, non-obvious modification, because substituting an array of coils for a single coil; or a single coil for a plurality of coils, is a readily obvious modification to an individual of ordinary skill in the MRI / NMR art.

50. With respect to **Amended Method claim 18**, **Hajnal** teaches and / or shows "A method for imaging an extended volume of interest within a subject using a Magnetic Resonance Imaging (MRI) system comprising: translating the subject into an imaging portion of a magnet assembly of the MRI system; detecting a plurality of MR signals from a radio frequency (RF) coil array;" and, sending the plurality of MR signals "to a" receiver assembly, (i.e. RF coils 9 and 10 in combination) with the receiver being adapted to adjust a receiver parameter; wherein the receiver parameter is adjusted based on direction of the image parallel to a motion of the subject" (i.e. the received acquired k-space signals are adjusted to account for motion along (i.e. "parallel to") the z imaging axis which is the axis of continuous patient motion, with the data then being sorted and aligned to match anatomic z locations, (i.e. directions of the image which are parallel to a motion of the subject.)) [See **Hajnal** Figures 1-9, abstract, col. 2 line 19 through col. 7 line 25] for the same reasons as noted in the rejection of **claim 9**, above, which need not be reiterated.

51. **Hajnal** teaches and / or shows the step of "reconstructing at least one image of the volume of interest by computing a plurality of respective sub-images corresponding to the plurality MR signals" from the receiver "and for the given field-of-view (FOV) at a

plurality of incremented locations of the subject as the subject is translated and combining the plurality of respective sub-images to form a composite image of the volume of interest" (i.e. a image of a patients abdomen). [See Figures 1-9 col. 2 line 19 through col. 7 line 25]. The limitation of "wherein the combining comprises combining a central portion of each sub-image to form the composite image" is also taught by **Hajnal,** see col. 6 lines 19-43, in combination with col. 5 line 1 through col. 7 line 25.

52. **Hajnal** lacks directly teaching that there are explicitly "a plurality of receivers" configured in adjust the receiver parameter with the exact terminology of "based on a direction of the image parallel to a motion of the subject", as mentioned in the rejection of **claim 9,** above, and are also suggested by **Hajnal** and/or the combination of the **Hajnal, and Pelc et al.,** references for the same reason as those given in the rejection of **claim** 9 which need not be reiterated. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claim 9** also apply to **claim 18** and need not be reiterated.

53. With respect to method **claim 10**, and **corresponding method claim 21**, which depend respectively from amended **independent method claims 9**, and **18; Hajnal** teaches and shows that "the at least one RF coil array is mounted on a fixture that is disposed about the subject. {See RF coil reception assembly 9, 10 col. 3 line 38 through col. 4 line 3; and figures 1-3, 9]. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 10,** and **21**.

54. With respect to method **claim 11**, and **corresponding method claim 22**, which depend respectively from amended **independent method claims 9**, and **18; Hajnal** teaches and suggests from figures 1-3 and 9 that "the fixture and RF coil array mounted thereon are stationary relative to the static magnetic field." {See Figures 1-3, 9col. 3 line 38 through col. 7 line 25} The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9, 10, 18,** and **21** also apply to **claims 11** and **22.**

55. With respect to method **claim 12**, and **corresponding method claim 23**, which depend respectively from amended **independent method claims 9**, and **18; Hajnal** lacks directly teaching that "the fixture and RF coil array mounted thereon are moveable

relative to the static magnetic field." However, **Pelc et al.,** teaches that this limitation is an alternative configuration for a plurality of reception coils. {See abstract, figure 1; col. 2 line 4 through col. 4 line 65} Therefore, because the substitution of a plurality of receiver coils for a single receiver coil is well known, {See the rejection of **claims 9, 18**} the modification taught by **Pelc et al.,** when using a plurality of reception coils would also have been obvious to one of ordinary skill in the art at the time that the invention of **Hajnal** was made. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims, 9, 10, 18,** and **21** also apply to **claims 12** and **23.**

56. With respect to method **claim 13**, and **corresponding method claim 20**, which depend respectively from amended **independent method claims 9**, and **18; Hajnal and Pelc et al.,** show "the at least one rf coil array comprises a plurality of coil elements arranged in a orthogonal distribution relative to a frequency encoding direction" {See Rf coils 9,10 and Figures 1-3, 9 of **Hajnal** and/or figure 3 of **Pelc et al.,**]. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 13** and **20.**

57. With respect to method **claim 14**, and **corresponding method claim 24**, which depend respectively from amended **independent method claims 9**, and **18; Hajnal** teaches that "at least one rf coil array detects the MR signals concurrently with the translation of the positioning device". {See col. 5 line 1 through col. 7 line 25] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 14** and **24.**

58. With respect to **method claim 15**, and **corresponding method claims 25**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Hajnal** teaches and shows that "the translating step is repeated until a selected length of the subject has been imaged inside the imaging portion of the magnet." {See col. 5 line 28 through col. 57 line 25]. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 15** and **25.**

59. With respect to **method claim 17**, and **corresponding method claims 19**, which depend respectively from **independent method claim 9**, and **independent**

method claim 18; Hajnal suggests that "the extended volume of interest" acquires slices as the patient is translated into the MR device in a "head-to-toe" direction, because the slices are acquired sequentially from z1 through z4 for volumes A, B, C, D therefore using the **Hajnal** apparatus a patient inserted into the imaging bore head first will intrinsically be imaged in a head-to-toe manner, while a patient inserted into the imaging bore feet first will intrinsically be imaged in a "toe-to-head" manner. [See Figures 1-3, 9; abstract, col. 2 line 19 through col. 7 line 25. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 17** and **19**.

60. With respect to **method claim 26**, **Hajnal** teaches that "the translating step is substantially continuous". [See col. 5 line 1 through col. 7 line 25, abstract] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claim 26**.

61. With respect to **method claim 32**, and **corresponding method claims 36**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Hajnal** teaches and shows that "the receiver parameter comprises a receiver frequency, (i.e. the Larmour resonance frequency [See col. 1 lines 5-28]) "and wherein the receiver frequency is adjusted in response to a translation of the positioning device;" [See col. 6 lines 19-65] "wherein the receiver frequency is adjusted when a frequency encoding direction of the image is parallel to an axis of a motion of the subject", so that different imaging volumes can be collected in the direction of patient motion. [See col. 5 line 1 through col. 7 line 25] where the data is re-aligned and frequency adjusted to match z locations in the same direction (i.e. parallel to the axis of patient table motion)]. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 32** and **36**.

62. With respect to **method claim 33**, and **corresponding method claims 37**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Hajnal** teaches and shows that "the receiver parameter comprises a receiver phase, and wherein the receiver phase is adjusted in response to a translation of the positioning device; wherein the receiver phase is adjusted when a phase

encoding direction of the image is parallel to an axis of a motion of the subject". [See col. 6 line 51 through col. 7 line 25; where the receiver phase encodes different locations with different orderings when motion in the table direction is continuous.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 33** and **37**.

63. With respect to **method claim 34**, and **corresponding method claims 38**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Hajnal** teaches and shows that "the rf coil array is configured to adjust a transmit frequency in response to a translation of the positioning device; [See col. 6 lines 19-43,where the frequency is adjustable as needed to encode locations in the direction of patient motion.]["and wherein the transmit frequency is adjusted when a slice selection direction of the image is parallel to an axis of a motion of the subject". [See col. 6 line 19 through col. 7 line 25, especially, col. 7 lines 17-25, where the same process is taught to be applicable to slice selection as well.] The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 34** and **38**.

64. With respect to **method claim 35**, and **corresponding method claims 39**, which depend respectively from **independent method claim 9**, and **independent method claim 18; Hajnal** lacks directly teaching that "the computing of the sub-images acquired from each receiver is offset by a fraction of the field of view, wherein the fraction of the field of view equals the field of view divided by a number of receivers." However, **Pelc et al.,** teaches this limitation. [See **Pelc et al.,** col. 2 lines 59-67 ; col. 3 lines 13-29 ; col. 3 lines 37-45; col. 3 line 54 through col. 4 line 3; and especially col. 4 lines 18-33 where in a four coil receiver system the offset for $\Delta Z/Z$ is ~0.25 with a 75% efficiency for a given FOV; and se also col. 4 lines 50-65].

65. The examiner notes that it also would have been obvious to one of ordinary skill in the art at the time that the invention was made to modify the teaching of **Hajnal** with the teaching of **Pelc et al.,** because as mentioned in the rejection of claim 9, replacing a single coil with a coil array permits the multiple volumes A, B, C, D, to all be acquired within the same scan without a retuning step, when each coil is tuned to a separate

frequency, and shortens the overall imaging time which is highly desirable. The same reasons for rejection, obviousness, and motivation to combine, that apply to **claims 9,** and **18** also apply to **claims 35** and **39**.

Prior art of Record

66. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

A) **Meaney et al.**, US patent 5,924,987 issued July 20th 1999 which teaches obtaining data from the center of k-space for multiple fields-of-view and concatenating in a mosaic fashion the central k-space data to make an overall image.

B) **Wang et al.**, US patent 5,928, 148 issued July 27th 1999.

C) **Machida** US patent application publication 2002/0115929 A1 published August 22nd 2002; with an effective filing date of September 21st 2001;

D) **Kruger et al.,** US patent application publication 2002/0173715 A1 published November 21st 2002, filed November 26th 2001, which teaches a method for acquiring MRI data from a large field-of-view using continuous table motion.

E) **Brittain et al.**, US patent application publication 2003/0011369 A1 published January 16th 2003, filed September 4th 2002, which teaches a method for acquiring MRI data from a large field-of-view using continuous table motion, and is a **continuation-in-part** of **Brittain 2002/0173715 A1** applied above.

F) **Brittain** US patent application publication 2004/0155654 A1 published August12th 2004, filed December 30th 2003, which teaches a method for acquiring MRI data from a large field-of-view using continuous table motion, and is a **continuation** of **Brittain 2002/0173715 A1** applied above.

G) **Demoulin et al.**, US patent application publication 2003/0100825 A1 published May 29th 2003, filed November 21st 2001, which teaches a method and system for extended volume imaging using MRI. The examiner notes that this reference is noted for the purposes of a complete record, but does not constitute prior art against the claims of the instant application because it is applicant's own earlier work, and was filed less than a year before the filing of applicant's instant application.

H) **Demoulin et al.**, US patent 6,584,337 B2 issued June 24th 2003, filed November 21st 2001, which corresponds to **Demoulin et al.**, 2003/0100825 A1 and teaches a method and system for extended volume imaging using MRI. The examiner notes that this reference is noted for the purposes of a complete record, but does not constitute prior art against the claims of the instant application because it is applicant's own earlier work, and was filed less than a year before the filing of applicant's instant application.

I) **Zhu et al.**, US patent application publication 2004/0051529 A1 published March 18th 2004, filed September 12tht 2002, which is the publication of applicant's instant application as originally filed. The examiner notes that this reference is noted for the purposes of a complete record, but does not constitute prior art against the claims of the instant application because it is applicant's own work.

Conclusion

67. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is: (571) 272-2241. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

68. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez, can be reached at (571) 272-2245. The **only official fax phone number** for the organization where this application or proceeding is assigned is **(703) 872-9306**.

Tiffany A. Fetzner
TAF
September 17, 2004

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